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ABSTRACT

This bulletin provides standards and recommendations for facilities to be used for high school agricultural departments. Consideration is given to classroom and shop space, storage space, heating, lighting, wiring, plumbing, and ventilation. Tools and equipment needed for the shop are listed in an appendix. Floor plans for shop facilities designed for the special needs of farm mechanics instruction are included. (FS)

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Planning Building Facilities for Vocational Agriculture

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for
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The University of the State of New York
The State Education Department
Division of School Buildings and Grounds
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INTRODUCTION

This bulletin provides standards and recommendations for facilities to be used for high school agricultural departments. The information will be helpful to school officials, committees and architects in studying the needs for facilities and in developing school plans. The standards indicate minimums. The adjustment of these standards to meet the needs of larger class sizes should be given careful study at the time facilities are planned.

The increased mechanization of farms and the relationship of machines to scientific production practices make it imperative that both pupils in school and out-of-school young farmers receive training in the care, use, repair and maintenance of the machines and equipment they use. Plans for shop facilities designed for the special needs of farm mechanics instruction will be found in this bulletin.

Placing the classroom adjacent to the agricultural shop permits the teacher to supervise both rooms in which are carried on conference type discussions and laboratory activities for making farm plans.

Credit for a facilities study and the preparation of the initial manuscript of this bulletin is given to Dr. William Kunsela, director of the State University Agricultural and Technical Institute at Delhi, formerly head of the Agricultural Education Division of the Rural Education Department at Cornell University. Dr. Harold L. Noakes, associate in the Bureau of Agricultural Education, State Education Department, worked with the Bureau of Agricultural Education staff to revise the manuscript and then prepared the final bulletin in cooperation with Basil Hick, associate in school buildings and grounds, State Education Department.

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March 1957
Albany, New York

PLANNING BUILDING FACILITIES FOR VOCATIONAL AGRICULTURE

PROGRAM

Agricultural instruction is designed to provide an opportunity for present and prospective farmers and others interested in agriculture, to acquire those skills, attitudes and understandings essential to efficient production and to useful and satisfying rural living.

The content of the agricultural curriculum is based on a functional analysis of the everyday problems with which farmers are faced. The design of building facilities to house the agricultural department, therefore, needs to make provision for the "doing" phase of the farmer's job that can be as efficiently and effectively taught in the school as on the farm. A relatively large number of farm problems and jobs can be brought to the school for more efficient group instruction without materially reducing the quality of the learning experience.

The development of mechanical skills and understandings essential to the maintenance, adjustment, operation and repair of farm machinery through individual experiences is an essential phase of agricultural instruction. The construction, maintenance, use and repair of farm equipment; the testing of soils, milk and seeds; the grading and candling of eggs; the grading of hay and ensilage; the butchering of farm animals; the culling, killing and dressing of poultry; the planning for construction and rearrangement of farm buildings, and the fitting of hand tools are a few of the farming abilities and skills which are acquired in the agricultural shop and classroom.

The quality of the agricultural course is dependent to a large extent on how well the school provides the facilities to make effective learning possible.

It is the responsibility of the school with agriculture in the curriculum to provide facilities for inschool pupils, out-of-school young men and adults on a year-round basis. Instruction to young men on farms who are concerned with establishment, production, mechanical and management problems is an integral part of the school's curriculum in agriculture.

Although preparation for farming will continue to be the primary responsibility of an agricultural department, agricultural instruction should be provided for pupils from rural nonfarm homes. Instruction in such areas as gardening, landscaping, plumbing, wiring, home

safety, buying, home improvement, home maintenance and repair is an appropriate offering in general courses of agricultural education. Instruction in agriculture may also be offered to pupils at the junior high school level, to assist them in making wise vocational choices.

The variety of responsibilities assumed by agricultural departments requires special attention to design and space allocation. The physical plant housing the agricultural department must provide for a variety of classroom and shop experience suitable for high school pupils, young farmers and adults for 12 months of the year, for day and evening instruction and meetings.

CLASSROOM SPACE

The minimum-sized classroom for an anticipated class size of 12 pupils should include at least 400 square feet of floor space. An additional 25 square feet should be allowed for each pupil above this number. To provide for conference type seating arrangement the classroom should be at least 20 feet in width. The classroom size for a two-teacher department should be at least 800 square feet with a folding partition provided to divide the classroom into two approximately equal areas.

SHOP SPACE

The minimum-sized shop for agriculture should include at least 1,500 square feet for an anticipated class of 12 pupils. An additional 75 square feet should be provided for each pupil above this number.

The care, maintenance and repair of tractors, balers and field choppers; the construction of brooder houses, range shelters and elevators require a shop at least 25 feet wide with a minimum clear height of 11 or 12 feet. The floor space should be unobstructed by pillars or projecting corners to facilitate movement of equipment or projects under repair or construction.

CLASSROOM-SHOP COMBINATION

When anticipated class size is materially below 12, a minimum of 1,600 square feet may be provided for a classroom-shop combination. A folding partition containing a small door should be placed 20 feet from one end of the area.

STORAGE

A storage room adjoining the classroom is desirable, particularly when the classroom is of minimum size. Built in or ready-made steel shelves are useful for texts and reference books. A standard four-

To provide for conference type seating arrangement the classroom should be at least 20 feet in width.

drawer letter file equipped with a steel partition in each drawer having twin compressors makes a dust-free, compact, efficient way of storing and organizing bulletins. Periodicals may be stored in racks designed for this purpose. Charts need a rack which suspends the material in a vertical plane. Cabinets containing sliding panels which hold and show approximately 100 slide films per panel are recommended. Built-in or ready-made steel general purpose cabinets are available for storing sample and specimen bottles, soil testing kits and numerous other instructional aids.

Care should be used in designing new structures to leave unobstructed wall space for storage purposes.

Provision should be made when planning the agricultural shop, for storing tools, lumber, metal, paint and other shop supplies. It is recommended that tools be stored on open tool panels adjacent to specific work areas on walls or in the space above benches. The use of vertical storage racks for lumber and iron is recommended. Compartments should be provided for screws, nuts and bolts. Steel lockers should be arranged along one wall of the shop to provide storage space for work clothes and small repair or construction jobs.

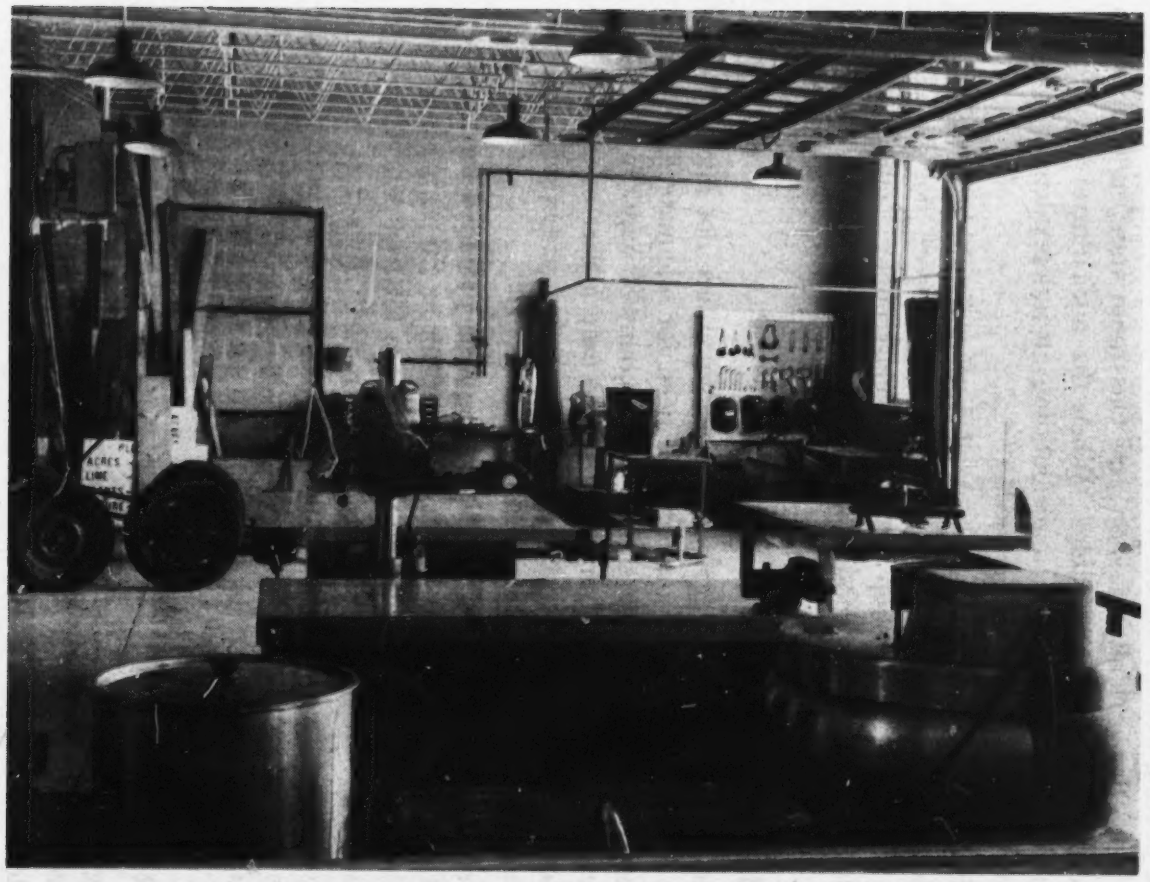
The shop should be planned around specific work areas. This development tends to decentralize tool and material storage resulting in the grouping of tools and materials in the area where the work is being done.

LOCATION OF AGRICULTURAL FACILITIES

It is recommended that the agricultural facilities be constructed as an integral part of the main school building or as part of another building located close to the main building. The agricultural facilities should be on the ground floor, preferably in a single-story wing facing away from the front of the building.

The classroom should adjoin the shop separated by a glass partition to facilitate supervision of activities occurring in the shop and classroom at the same time. The glass in the partition should begin high enough above the floor (approximately four feet) to provide utilization of wall space each side of the partition.

The shop should be adjacent to the agricultural classroom and located where a well-drained service road provides for the entrance of farm machinery. Space for machinery storage outside the shop should be provided. The shop should have a machinery entrance door at least 14 feet wide and 10 feet high, located at least 8 feet from the corner of the shop. An outside pupil entrance door should also be provided. The floorspace near the overhead door should be kept free of installations.



A glass partition in the wall separating the classroom from the shop facilitates supervision of activities occurring in the classroom and shop at the same time.

The noises, odors and fumes associated with the farm shop suggests a location which would interfere as little as possible with other activities in the school building.

HEATING OF ROOMS

The heating system should be equipped with controls to permit the heating of the agricultural shop and classroom independently from the rest of the school building. When the agricultural department is located separate from the main building an independent, automatic heating system should be planned.

If fan-type overhead units are installed, they should be large enough to make low speed operation possible. The forced hot air unit is more adaptable to the shop than to the classroom. Temperature in the classroom and shop should be separately controlled.

LIGHTING

The light needs of the agricultural classroom are not different from those in any other classroom, but the need for adequate light cannot be overemphasized for the shop. The amount of window space and the wattage of artificial sources constitute only a part of the lighting problem. Brightness balance, reflection and glare are other important determinants to visual comfort and efficiency.

Care should be given to the natural lighting provided for the shop. Good natural light should be planned but not at the expense of wall space which is very necessary in the shop area for tool panels, cabinets and storage. Windows starting approximately four feet from the floor or series of windows separated by piers are two ways of obtaining ample natural light without sacrificing valuable wall space. Generally it is unnecessary to plan windows for two sides of a shop.

WIRING

Light control switches should be installed at each entrance in the classroom to make for ease of exit and entry at night. Conduits should be installed between the walls to make for unobstructed use of wall area. At least one power outlet should be installed in each wall to facilitate the use of projectors and closeup lamps.

Wiring circuits should be divided to permit lighting the dark side of the room without using all of the lights and provision should be made for portable or trouble lights in areas where extremely fine work is being done.

Milk testing facilities should be provided in areas where dairying is an important farm enterprise.

With a few exceptions the recommendations made for the classroom apply to the shop wiring layout. Readily accessible power outlets are needed for all stationary equipment. Both 110-volt and 220-volt service wall outlets should be placed at approximately 10-foot intervals around the entire shop at a height of approximately 42 inches from the floor. An underfloor duct system or overhead power tracks or retractable outlets serving equipment near the center of the shop interferes less with work than other types of installation and is out of the way when the equipment is not in use.

Provision should be made for 60-ampere 200-230 volt outlets adjacent to the welding area to make inside and outside welding possible. The switch panel should be mounted flush with the wall and equipped with a door which can be locked. It is recommended that this be located on an inside wall of the shop adjacent to the door to the classroom or corridor. The switch panel used should be of a minimum dimension for the capacity needed.

The placement of emergency circuit breakers at convenient locations in the shop is recommended. The power saw and jointer should be located where they will not prevent access of farm machinery. Care should be taken in the placement of this equipment to allow for the safe handling of long lengths of lumber. Wiring for heating, lighting, fire alarm and other service items should be located away from central areas of wallspace so they do not interfere with toolboards or other shop organization needs.

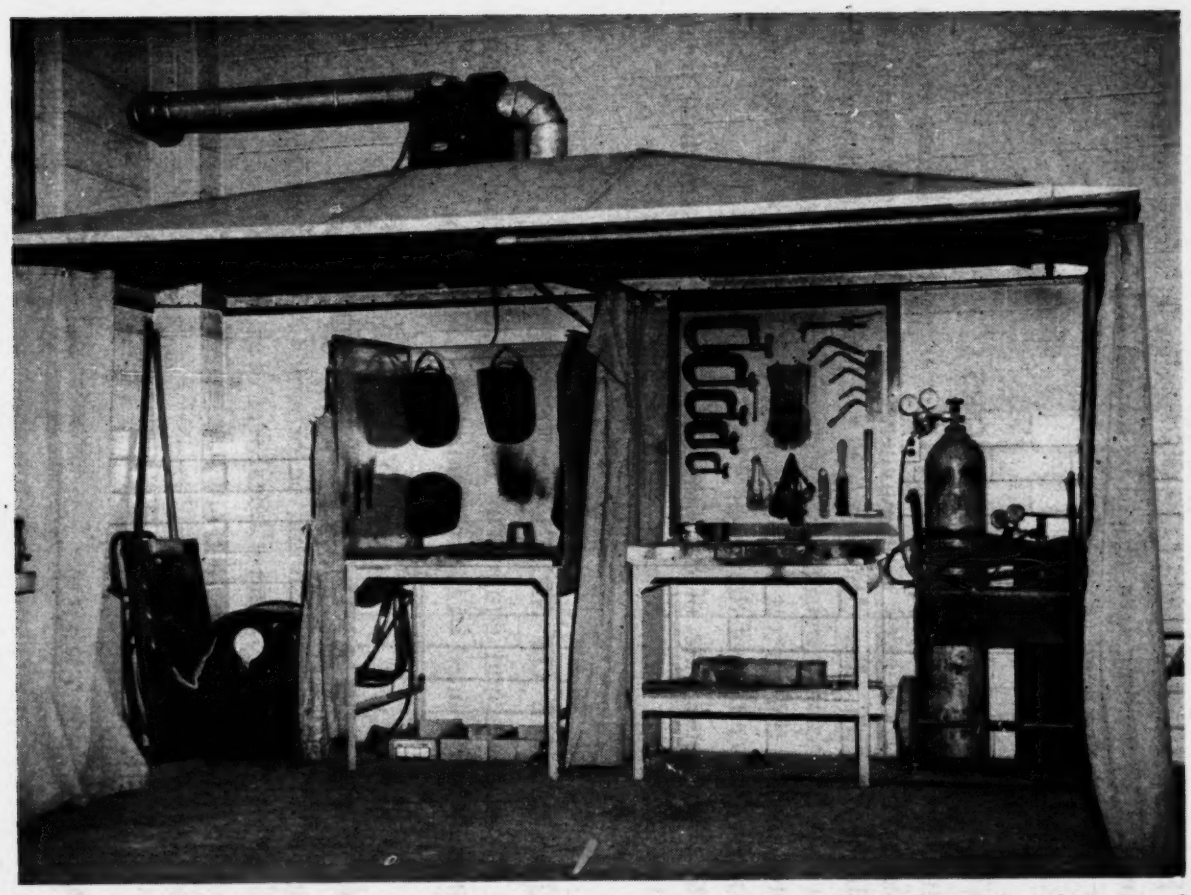
PLUMBING

In areas of the State where dairying is an important farm enterprise, milk testing facilities should be provided. These facilities should include an acidproof sink, usually stone, with a lead trap and drain connection; a storage bench with acid-resistant surface; a 24-36-bottle centrifuge and a bottle washer.

The milk testing area should be located in the shop where it can be observed from both classroom and shop. The milk testing sink may also be used as a wash sink for pupils. The sink should be supplied by both hot and cold running water.

Hose faucets should be provided both inside and outside the shop near the overhead door to provide for cleaning machinery and floors.

A floor drain should be installed inside the shop in the center of an area approximately 14 x 14 feet in front of the overhead door. The floor in this area should slope to the drain.



The welding area requires a special exhaust system to remove fumes from electric arc and oxyacetylene welding.

VENTILATION

For electric welding, a special exhaust system is needed that removes the fumes through an overhead hood equipped with fan or by means of a fan of at least 18 inches diameter with outside louvers, placed in outside wall within the welding area. A flexible metal tube, connected to a rigid pipe, leading directly to the outside of the building has been found useful to carry off exhaust fumes from running engines. The welding area should be located adjacent to the overhead door between drainage area and end wall.

WALLS, CEILINGS AND FLOORS

Shop floors should be made of reinforced concrete strong enough to support heavy pieces of equipment. The classroom should be finished similar to other classrooms in the building. The walls of the shop may be exposed masonry construction. This surface should be painted to give the correct reflective value. The slab of the roof may be used as the ceiling of the shop.

The ceiling and walls of the shop should be given acoustical treatment according to the advice of an acoustical engineer.

MAJOR ITEMS OF SPECIAL EQUIPMENT

A list of tools and equipment recommended for the agricultural department is included in the appendix to this bulletin.

CHALKBOARDS AND BULLETIN BOARDS

Agriculture classrooms should be provided with a minimum of 12 lineal feet of chalkboard and 4 lineal feet of corkboard.

Approximately 6 lineal feet of chalkboard should be provided in the agriculture shop.

CHAIN HOIST TRACK

A track to accommodate a one-ton chain hoist should be built into the ceiling in order that tractors or other farm machinery may be disassembled and taken to a bench for study and repair. This track should run from a spot approximately over the floor drain to a wall of the shop so that chain hoist can be moved out of the way when not in use. An " A " frame hoist may be used when storage space is provided for it outside of the shop.

APPENDIX

Tools and Equipment for Agriculture and Farm Mechanics Taught by a Teacher of Agriculture

The following suggestions are made for classes of 12 to 14 pupils. Selections should be made from these lists, giving consideration to the type of instruction to be offered and the number of pupils to be served. Where possible the teacher of agriculture should be allowed to help decide on the tools and equipment appropriate to the local situation. This may include additional items in some instances.

In addition to the equipment listed, other items falling into the classification of supplies will be needed. Supplies frequently used should be kept on hand and other supplies purchased as needed.

Furniture for Agricultural Classrooms

6–7 classroom tables, approximately 2′ 6″ x 46″
1 teacher's desk and chair
1 book and supply case (usually built in)
12–14 chairs
1 4-drawer filing cabinet
1 4-drawer cabinet with divider in drawers for bulletins

General Equipment for Agricultural Teaching

1 milk testing bench, supply case, and acid-resistant sink
1 Babcock milk testing outfit with glassware (24-bottle size or larger, electric preferred)
1 test bottle washer
1 dairy thermometer
1 lactometer
2 milk sample dippers
4 sets of milk sample bottles, 24 each or larger
2 milk scales (60 pounds)
2 wing tip dividers
1 small hand sprayer or duster
2 pruning saws
2 pruning shears, hand
2 school drawing outfits, consisting of board 17″ x 22″, T-squares and celluloid triangles
2 triangular boxwood scales
1 set of drawing instruments
1 brass protractor
1 soil acidity testing outfit
1 soil auger or sampling tube
1 round pointed shovel, short handle
1 crowbar

Benches and Machines for Shop

2 double workbenches, approximately 54″ x 32″ each, equipped with two rapid-acting vises and stops
1–2 metal working benches, approximately 2′ x 8′ or 10′, equipped with 1 pipe vise and 2 metal vises
1–3 tool cases or tool display boards (shop built)
1 180A-250A electric welding outfit, including hoods and proper shielding
1 acetylene welding and cutting outfit, including goggles or hoods
1 lumber rack (shop built)—suggest vertical type
1 iron storage rack (shop built)—suggest vertical type
1 supply case (shop built)
1 welding table, fire brick top (shop built) for gas welding
1 welding table, steel top, with vise for arc welding (shop built)

Electric Power Machines

These are listed in order of desirability of purchase. All machines must be equipped with safety guards.

2 electric farm grinders, one for rough grinding, one for tool sharpening
1 electric drill, portable with stand (½″ chuck)
1 electric circular saw, 10″, ¾ H. P., tilting arbor
1 electric drill press, slow speed, ½″ chuck
1 electric jointer, 6″

The following machines are used to advantage in some schools but purchase should be limited to needs of program in progress:

1 valve refacer
1 valve seat grinder
1 air compressor and paint gun
1 metalworking lathe
1 power hacksaw
1 surface planer
1 steam jenny (or access to one)

Woodworking Tools

2 nail hammers — 10 oz. bent claw
2 nail hammers — 13 oz. bent claw
2 nail hammers — 16 oz. straight claw
2 24″, 8-point crosscut handsaws
3 22″, 10-point crosscut handsaws
2 26″, 6-point, hand ripsaws
2 12″, backsaws
2 14″, iron jackplanes
2 block planes, 6″
2 smoothing planes, 9″
1 10″, 10-point keyhole saw
1 14″, 8-point compass saw
2 coping saws with extra blades
2 handsaw sets
1 timber saw set
1 circular saw set

1 set of 13 auger bits, ¼"–1"
1 expansion bit, ⅞" to 3"
1 electrician's bit, ⅝"
1 10" sweep ratchet braces
2 8" sweep ratchet braces
2 rose countersinks
3 screwdriver bits, 1–5/16", 2–⅜"
1 2" screwdriver, shockproof
2 4" screwdrivers, shockproof
2 6" screwdrivers, shockproof
2 8" screwdrivers, shockproof
2 10" screwdrivers, shockproof
2 brad awls
6 nail sets (assorted)
1 set of wood chisels, ⅛" to 1" by eighths
6 6" extra-slim-taper triangular files
12 6" slim-taper triangular files
6 8" regular taper triangular files
1 10" rattail file
6 10" flat mill files
3 10" flat bastard files
3 10" half-round bastard files
2 12" half-round wood rasps
2 auger bit files
12 interchangeable metal file handles
1 24" spirit level — wood or metal
1 4½" broad hatchet
1 2 or 3 pound hand ax
1 24" wrecking bar
3 2¾ pound wooden mallets
1 rubber mallet
2 composition mallets — 8 oz.
4 8" steel wing dividers
2 10" T bevels
1 10" drawshave
1 spokeshave
2 2" x 8" combination carborundum oilstones
2 cabinetmaker's bar clamps — 4' lengths
6 C clamps — 2 each — 6", 8", 10"
1 chalk line and box of blue carpenter's chalk
3 putty knives
4 combination mitre and trysquare, 12"
2 24" steel squares
1 folding rule, 6'
4 rules, 2', nonfolding
2 glasscutters
1 wire file brush
2 oil cans, 4" and 8" spout
2 calipers, inside and outside 8"
2 sawhorses (shop built)
1 saw filing clamp (shop built)

Metalworking Tools

2 hacksaw frames with two dozen blades
2 12-ounce riveting hammers
1 8″ monkey wrench
1 10″ monkey wrench
1 18″ monkey wrench
2 10″ adjustable S or Crescent wrenches
2 8″ adjustable S or Crescent wrenches
2 6″ adjustable S or Crescent wrenches
1 4″ adjustable S or Crescent wrench
1 set Allen wrenches, 1/16-⅜″
2 hand drills
1 set twist drills, 1/16″–½″ by 64ths
1 set carbon drills, ½″ to 1″ by 32ds — ½″ shank
1 drill press vise — 3″
1 set of high speed drills, 1/16″ to ½″ by 64ths
3 combination 8″ pliers
2 7″ side-cutting pliers
1 6″ end-cutting pliers
1 long nose side-cutting pliers
1 snap on pliers
1 bolt clipper
3 ½″ cold chisels
2 ⅝″ cold chisels
2 ¾″ cold chisels
1 cape chisel — ¼″ cut
1 diamond point chisel — ½″
3 ¼″ hand punches
2 ⅜″ hand punches
1 ½″ hand punch
1 3/32″ pin punch
1 ⅛″ pin punch
1 3/16″ pin punch
4 center punches
2 rivet sets
1 whetstone
1 screw plate (stock, dies and taps), National coarse and National fine, ¼″ to ¾″ by 16ths
1 homemade farm anvil, (RR iron)
1 100-pound blacksmith's anvil, ⅞″ hardie hole
1 straight hardie, ⅞″ shank
1 hot cutter with handle — ⅞″ shank
1 cold cutter with handle
2 8-oz. ball peen hammers
2 12-oz. ball peen hammers
2 1-pound machinist's hammers
2 2-pound machinist's hammers
1 3½-pound cross peen engineer's hammer
1 grinding wheel dresser
1 pipe reamer, ¼″ to 1¼″
1 pipe vise (see metalworking bench)

1 pipe cutter
3 pipe wrenches — 10", 14", 18"
1 set pipe dies, ⅛" — 2"
1 tubing cutter
1 tubing flanger
2 goggles or shields, grinder
1 common square stake
2 sheet metal ring scribers

Soldering Equipment

2 tin snips straight, and curved cutting edge, one each
1 quart blowtorch
2 electric soldering irons, one 300 watts, one 100 watts
1 LP torch with assorted tips

Tools for Concrete Work

1 pointed trowel
1 flat trowel
1 shovel
1 hoe
4 star drills, assorted

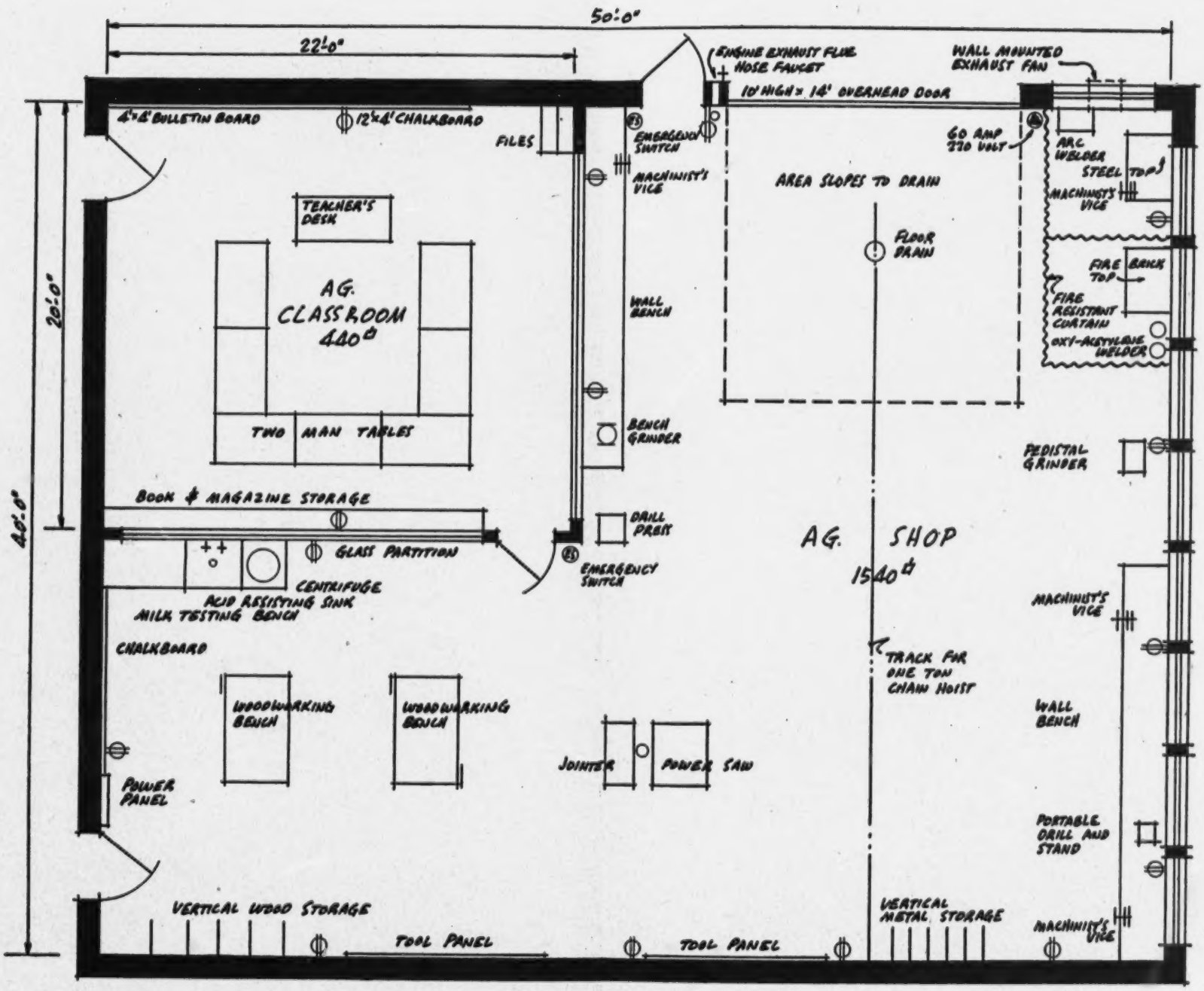
Leveling

1 farm leveling instrument with tripod, rod and target (get inexpensive type)
1 100-foot steel tape

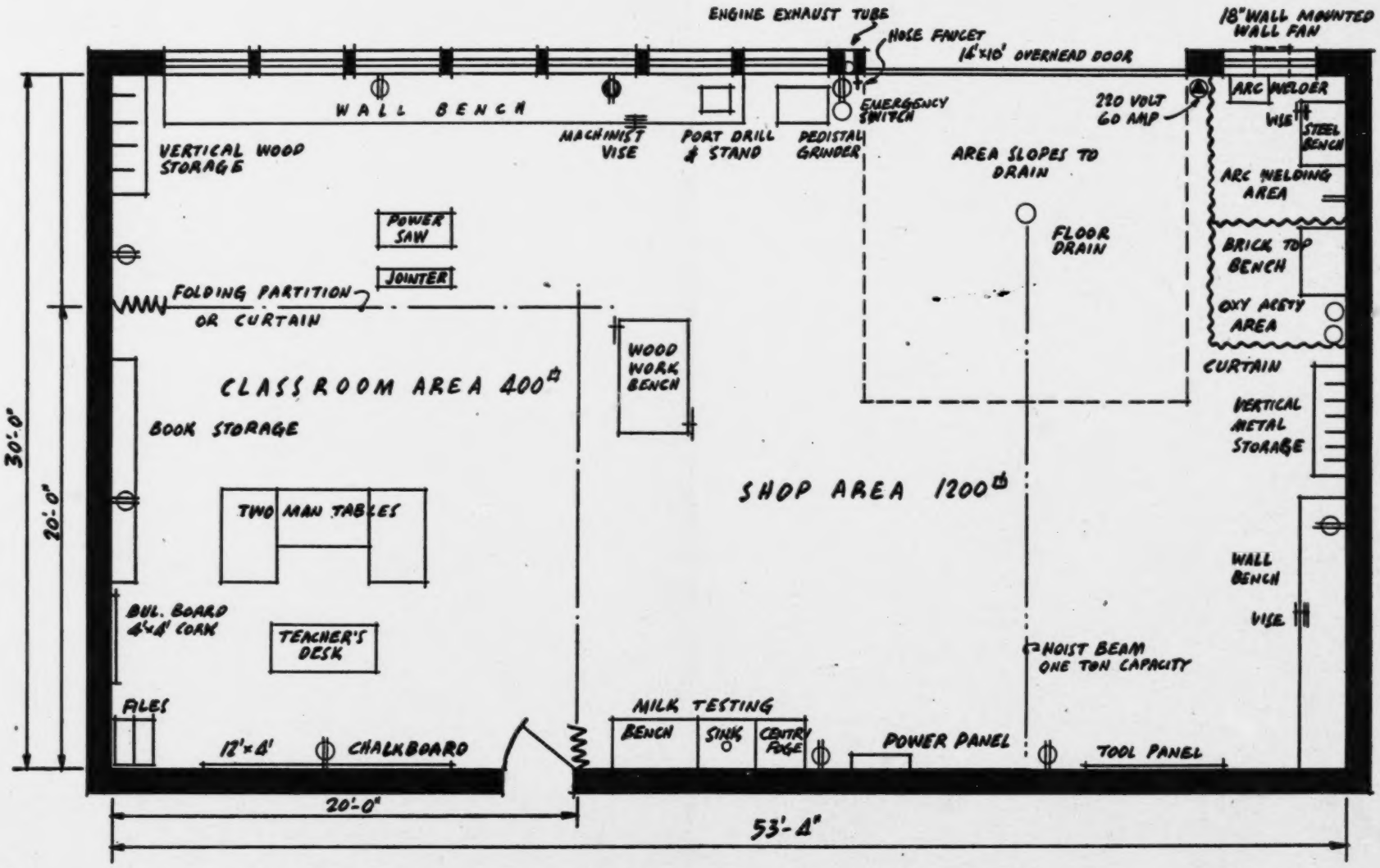
Tools for Automobile and Gas Engine Repair

1 set of ratchet socket wrenches, ½" drive
1 set of 10 engineer's double-end wrenches
1 set combination box socket and open end wrenches
2 Phillips screwdrivers — sizes 2, 3
1 aligning punch
1 vulcanizer for tube repairing
1 tire gage
1 tension wrench ½" drive
1 vacuum gage
1 compression tester
1 automobile jack
1 creeper
1 tire pump
1 hydrometer for battery testing
1 box valve grinding compound
1 valve-lifter, combination
1 valve grinder
1 water pump pliers
1 thickness gage set
1 gear puller with adapters

1 set spark plug wrenches
1 set of tappet wrenches
1 set extractors (Ezy-out or equal)
1 trouble lamp
6 magneto files
1 set ignition wrenches
1 voltage meter, prong type
1 chain hoist,1-ton
1 oil measure with funnel top
3 tin funnels, various sizes
2 safety horses
1 piston ring compressor
1 grease gun — zerk and alemite — lever type
1 speed indicator
1 wheel bolt wrench, 4-way

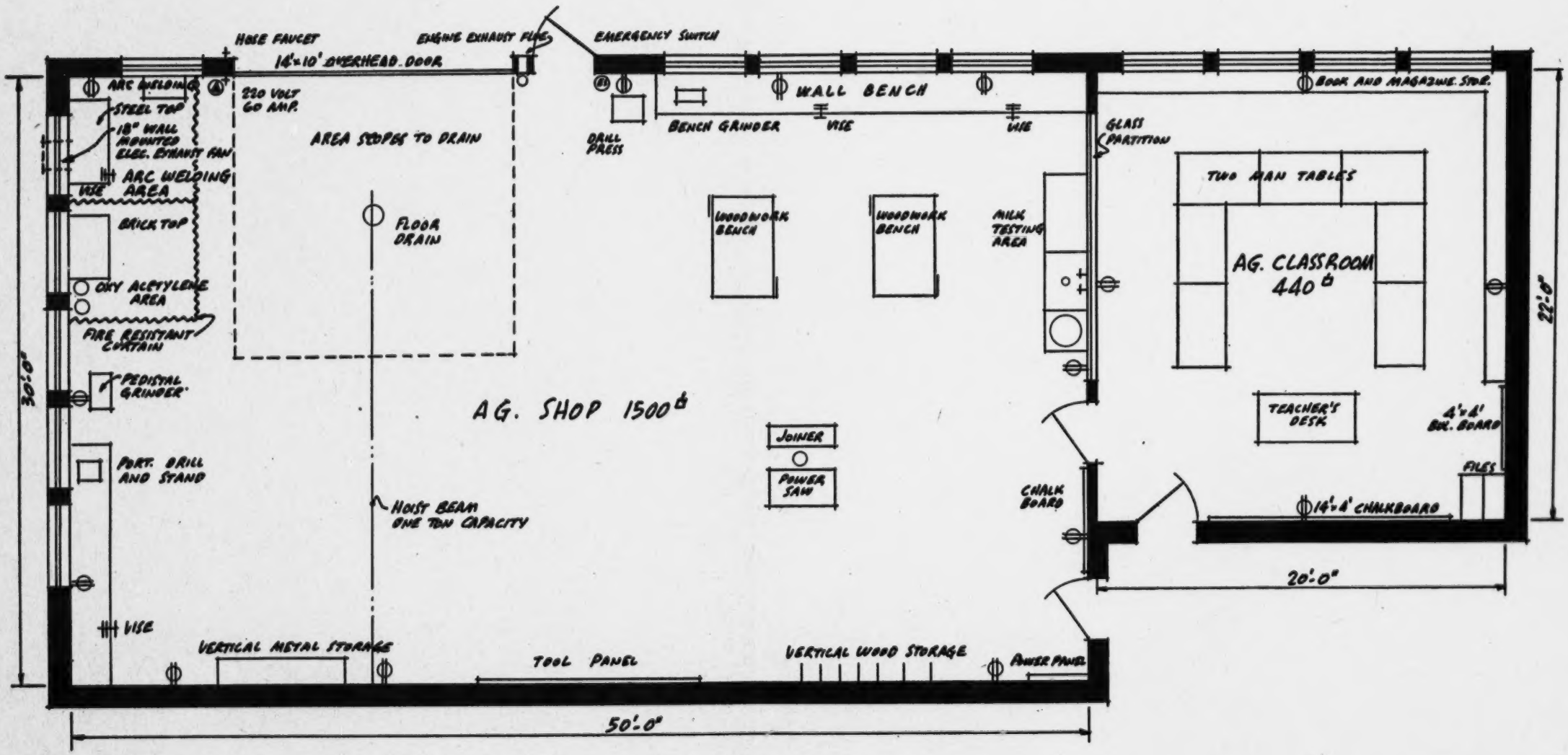


SUGGESTED AGRICULTURAL SHOP AND CLASSROOM



SUGGESTED AGRICULTURAL CLASSROOM SHOP COMBINATION

FOR SMALL DEPARTMENTS



SUGGESTED AGRICULTURAL SHOP AND CLASSROOM